



Class 11 Maths || Chapter 6 : Linear Inequalities || Class Notes

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Class 11 Maths chapter 6 Linear Inequalities

Rules:

① Add / Subtract

↓
sign of Inequality → (No change)

$$\begin{array}{r} 5 > 3 \\ -2 & -2 \end{array}$$

$$x + 2 > 5$$

$$x > 5 - 2$$

$$x > 3$$

② Multiply / Divide

⊕ve

Sign of Ineq.

No change

⊖ve

Sign of Ineq.

Change

Process

Single Inequality.

$$x > 5$$

Solve

Natural No.

↓
Set

Integers

↓
Set

Real No.

Interval

$$2 < x \leq 3$$

$$x \in (2, 3]$$

No. LINE

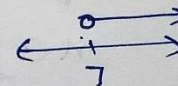
Include

$$x \geq 7$$



Exclude

$$x > 7$$



Exercise 6.1

① Solve $24x < 100$

(i) x is a natural No. $\rightarrow$ Set

(ii) x is an integer $\rightarrow$ Set

$$24x < 100$$

$$\Rightarrow x < \frac{100}{24}$$

$$\boxed{x < 4.22\dots} \text{ Ineq.}$$

(i) Natural No. $\{1, 2, 3, 4, 5, \dots\}$

Solution,

$$x \in \{1, 2, 3, 4\}$$

(ii) Integer $\{ \dots -2, -1, 0, 1, 2, 3, 4, 5, \dots \}$

$$x \in \{ \dots -2, -1, 0, 1, 2, 3, 4 \}$$

② Solve

$$\boxed{-12x > 30}$$

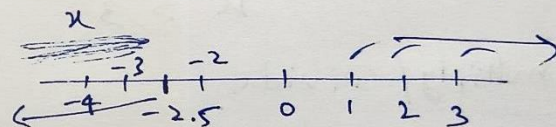
Solve

$$x < \frac{30}{-12}$$

$$\Rightarrow x < -\frac{5}{2}$$

$$\Rightarrow \boxed{x < -2.5} \checkmark$$

(i) x is a natural No. $\{1, 2, 3, \dots\}$



No Solution,

(ii) x is an integer $\{ \dots -2, -1, 0, 1, \dots \}$

$$x \in \{ \dots -5, -4, -3 \}$$

③ Solve $5x - 3 < 7$

$\Rightarrow 5x < 10$

$\Rightarrow x < \frac{10}{5}$

$x < 2$

(i) $x \in \text{Integer}$
Set

$x \in \{-2, -1, 0, 1\}$

(ii) $x \in \text{Real}$
Interval

$-\infty < x < 2$

$x \in (-\infty, 2)$
interval

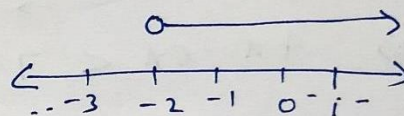
④ Solve $3x + 8 > 2$

$\Rightarrow 3x > 2 - 8$

$\Rightarrow 3x > -6$

$\Rightarrow x > -\frac{6}{3}$

$x > -2$



(i) $x \in \text{integer}$

Set

$x \in \{-1, 0, 1, \dots\}$

(ii) $x \in \text{Real.}$

Interval

$x > -2$

$-2 < x < \infty$

$x \in (-2, \infty)$

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Exercise 6.1

Linear Inequalities

Q.5

$$4x + 3 < 6x + 7$$

$$x \in \mathbb{R}$$

$$\Rightarrow 4x - 6x < 7 - 3$$

$$\Rightarrow -2x < 4$$

$$\Rightarrow x > \frac{4}{-2}$$

$$\Rightarrow \boxed{x > -2}$$

$$\Rightarrow -2 < x$$

$$\Rightarrow \boxed{-2 < x < \infty}$$

$$\boxed{x \in (-2, \infty)}$$

⊖ve. Divide

Sign → change

$$x \in (=, =)$$

$$[\quad)$$

$$(\quad]$$

$$[\quad]$$

(✓)

[x

⑥

$$3x - 7 > 5x - 1$$

$$\Rightarrow -7 + 1 > 5x - 3x$$

$$\Rightarrow -6 > 2x$$

$$\Rightarrow \frac{-6}{2} > x$$

$$\Rightarrow -3 > x$$

$$\Rightarrow x < -3$$

$$\Rightarrow \boxed{-\infty < x < -3}$$

$$x \in (-\infty, -3) \checkmark$$

2 → ⊕ve
(No change)

$$\textcircled{7} \quad 3(x-1) \leq 2(x-3)$$

$$\Rightarrow 3x-3 \leq 2x-6$$

$$\Rightarrow 3x-2x \leq -6+3$$

$$\Rightarrow x \leq -3$$

$$\Rightarrow -\infty < x \leq -3$$

$$x \in (-\infty, -3]$$

$$\text{Q.8.} \quad 3(2-x) \geq 2(1-x)$$

$$\Rightarrow 6-3x \geq 2-2x$$

$$\Rightarrow 6-2 \geq 3x-2x$$

$$\Rightarrow 4 \geq x$$

$$\Rightarrow -\infty < x \leq 4$$

$$x \in (-\infty, 4]$$

$$\textcircled{9} \quad \frac{x}{1} + \frac{x}{2} + \frac{x}{3} < 11$$

$$\Rightarrow \frac{6x+3x+2x}{6} < 11$$

$$\Rightarrow 11x < 66$$

$$\Rightarrow x < \frac{66}{11}$$

$$\Rightarrow x < 6$$

$$\Rightarrow -\infty < x < 6$$

$$x \in (-\infty, 6) \checkmark$$

$$\textcircled{10} \quad \frac{x}{3} > \frac{x}{2} + 1$$

$$\Rightarrow \frac{x}{3} - \frac{x}{2} > 1$$

$$\Rightarrow \frac{2x-3x}{6} > 1$$

$$\Rightarrow \frac{-x}{6} > 1 \Rightarrow \frac{x}{-6} > 1$$

$$\Rightarrow \frac{x}{-6} > 1$$

$$\Rightarrow x < -6$$

$$\Rightarrow -\infty < x < -6$$

$$x \in (-\infty, -6)$$

$$\textcircled{11} \quad \frac{3(x-2)}{5} \leq \frac{5(2-x)}{3}$$

$$\Rightarrow 9(x-2) \leq 25(2-x)$$

$$\Rightarrow 9x-18 \leq 50-25x$$

$$\Rightarrow 9x+25x \leq 50+18$$

$$\Rightarrow 34x \leq 68$$

$$\Rightarrow x \leq 2$$

$$\Rightarrow -\infty < x \leq 2$$

$$x \in (-\infty, 2] \checkmark$$

$$\boxed{13} \quad 2(2x+3)-10 < 6(x-2)$$

$$\Rightarrow 4x + \underline{6-10} < \cancel{12} 6x - 12$$

$$\Rightarrow \underline{4x - 6x} < 4 - 12$$

$$\Rightarrow -2x < -8$$

$$\Rightarrow +8 < 2x$$

$$\Rightarrow 4 < x$$

$$\Rightarrow \boxed{4 < x < \infty}$$

$$x \in (4, \infty)$$

$$\boxed{14} \quad 37 - (3x+5) \geq 9x - 8(x-3)$$

$$\Rightarrow 37 - 3x - 5 \geq \underline{9x - 8x} + 24$$

$$\Rightarrow -3x - x \geq -32 + 24$$

$$\Rightarrow -4x \geq -8 \quad x \in (-\infty, 2]$$

$$\Rightarrow x \leq \frac{-8}{-4} \Rightarrow \boxed{x \leq 2}$$

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Ex. 6.1 Linear Inequalities

$$\boxed{15} \quad \frac{x}{4} < \frac{(5x-2)}{3} - \frac{(7x-3)}{5} \quad x \in \mathbb{R}$$

$$\Rightarrow \frac{x}{4} < \frac{25x-10-21x+9}{15} \quad \text{Interval}$$

$$\Rightarrow 15x < 4(4x-1)$$

$$\Rightarrow 15x < \underline{16x} - 4$$

$$\Rightarrow 15x - 16x < -4$$

$$\Rightarrow -x < -4$$

$$\Rightarrow (-1) \cdot x < -4$$

$$\Rightarrow x > \frac{-4}{-1}$$

$$\Rightarrow x > 4$$

$$\Rightarrow 4 < x < \infty$$

$$x \in (4, \infty) \quad \checkmark$$

16

$$\frac{(2x-1)}{3} \geq \frac{(3x-2)}{4} - \frac{(2-x)}{5}$$

$$\Rightarrow \frac{2x-1}{3} \geq \frac{15x-10-8+4x}{20}$$

$$\Rightarrow \frac{2x-1}{3} \geq \frac{19x-18}{20}$$

$$\Rightarrow 40x-20 \geq 57x-54$$

$$\Rightarrow 40x-57x \geq 20-54$$

$$\Rightarrow -17x \geq -34$$

$$\Rightarrow x \leq \frac{-34}{-17} 2$$

$$\Rightarrow x \leq 2$$

$$\Rightarrow -\infty < x \leq 2$$

$$x \in (-\infty, 2]$$

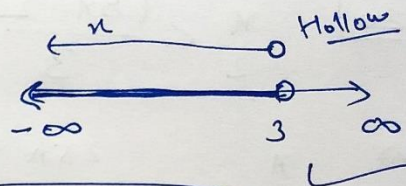
17

$$3x-2 < 2x+1$$

$$\Rightarrow 3x-2x < 2+1$$

$$\Rightarrow x < 3$$

$$x \in (-\infty, 3)$$



18

$$5x-3 \geq 3x-5$$

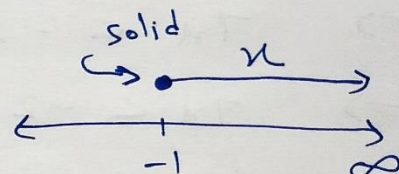
$$\Rightarrow 5x-3x \geq 3-5$$

$$\Rightarrow 2x \geq -2$$

$$\Rightarrow x \geq \frac{-2}{2}$$

$$\Rightarrow x \geq -1$$

$$x \in [-1, \infty)$$



19

$$3(1-x) < 2(x+4)$$

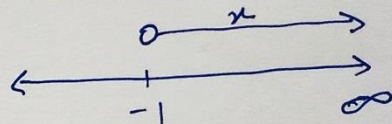
$$\Rightarrow 3-3x < 2x+8$$

$$\Rightarrow 3-8 < 2x+3x$$

$$\Rightarrow -5 < 5x$$

$$\Rightarrow \frac{-5}{5} < x$$

$$\Rightarrow -1 < x$$



Solⁿ: $x \in (-1, \infty)$

$$\boxed{20} \quad \frac{x}{2} < \frac{(5x-2)}{3} - \frac{(7x-3)}{5}$$

$$\Rightarrow \frac{x}{2} < \frac{25x - 10 - 21x + 9}{15}$$

$$\Rightarrow 15x < 8x - 2$$

$$\Rightarrow 7x < -2$$

$$\Rightarrow 7x < -2$$

$$\Rightarrow \boxed{x < -\frac{2}{7}}$$

$$\begin{array}{c} \leftarrow x \quad 0 \end{array}$$

$$\begin{array}{c} \leftarrow \quad \quad \quad | \quad \quad \rightarrow \\ -\infty \quad \quad -\frac{2}{7} \end{array}$$



$$\boxed{x \in (-\infty, -\frac{2}{7})}$$



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Class-11-Maths Exercise 6.1

Q.21 1st test $\rightarrow 70$ ✓

2nd test $\rightarrow 75$ ✓

3rd Test $\rightarrow x$ (let) ✓

Average $\rightarrow$ at least 60 marks.

$$\text{Average} \geq 60$$

$$\Rightarrow \frac{70+75+x}{3} \geq 60$$

$$\Rightarrow 145+x \geq 180 \quad \uparrow$$

$$\Rightarrow x \geq 180-145$$

$$\Rightarrow \boxed{x \geq 35}$$

$$\boxed{\text{Marks of 3rd Test} \geq 35}$$

$\therefore$ minimum
marks in
III test = 35

Q.22 Marks in first four
tests = 87, 92, 94, 95

Marks in Fifth Exam = x (let)

Grade 'A' $\rightarrow$ Average ≥ 90
★

$$\Rightarrow \frac{87+92+94+95+x}{5} \geq 90$$

$$\Rightarrow \frac{368+x}{5} \geq 90$$

$$\Rightarrow 368+\underbrace{x}_{\uparrow} \geq 450$$

$$\Rightarrow x \geq 450-368$$

$$\Rightarrow \boxed{x} \geq 82$$

min. Marks in (V) Exam = 82

$\uparrow$

(23)

Two consecutive
odd positive integers < 10
& Sum > 11

Pair $\rightarrow$ $\begin{pmatrix} \text{Small} & \text{Big} \\ 2n+1 & 2n+3 \end{pmatrix}$
odd odd
consecutive
 $n \in \mathbb{I}$

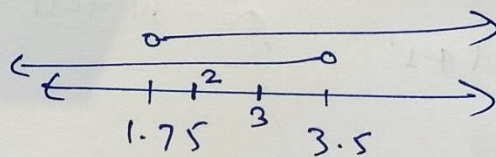


$$\begin{aligned}
 2n+3 &< 10 \quad \text{--- (1)} \\
 \text{Sum} &> 11 \\
 \Rightarrow (2n+1) &+ (2n+3) > 11 \\
 \Rightarrow 4n+4 &> 11 \\
 \Rightarrow 4n &> 7 \\
 \Rightarrow n &> \frac{7}{4} \\
 \Rightarrow n &> 1.75
 \end{aligned}$$

$$2n < 7$$

$$n < \frac{7}{2}$$

$$n < 3.5$$



$$n \in (1.75, 3.5)$$

$$n = 2, 3 \in \mathbb{I}$$

Pairs $(2n+1, 2n+3)$

$$\underline{n=2} \quad (5, 7)$$

$$\underline{n=3} \quad (7, 9)$$

2A Two Consecutive
(Even positive integers) $> 5 \rightarrow$ Smaller > 5

$$\boxed{\text{Sum} < 23}$$

Assumes.

$x \in \mathbb{I}$
★

small B.T.R
($2x, 2x+2$)
Even Even
(consecutive)

$$\text{Sum} < 23$$

$$\Rightarrow (2x) + (2x+2) < 23$$

$$\Rightarrow 4x + 2 < 23$$

$$\Rightarrow 4x < 21$$

$$\Rightarrow x < \frac{21}{4}$$

$$\Rightarrow \boxed{x < 5.25} \quad \star$$

$$2x > 5$$

$$\Rightarrow x > \frac{5}{2}$$

$$\Rightarrow \star \boxed{x > 2.5}$$

$$\underline{x = 3, 4, 5} \quad \checkmark$$

Pairs ($2x, 2x+2$)

$$\underline{x=3} \quad (6, 8) \quad \checkmark$$

$$\underline{x=4} \quad (8, 10) \quad \checkmark$$

$$\underline{x=5} \quad (10, 12) \quad \checkmark$$

Q.25

the longest side = $3x$

third side = $3x - 2$

the shortest side = x (let)

Perimeter ≥ 61

$$\Rightarrow (3x) + (3x - 2) + (x) \geq 61$$

$$\Rightarrow 7x - 2 \geq 61$$

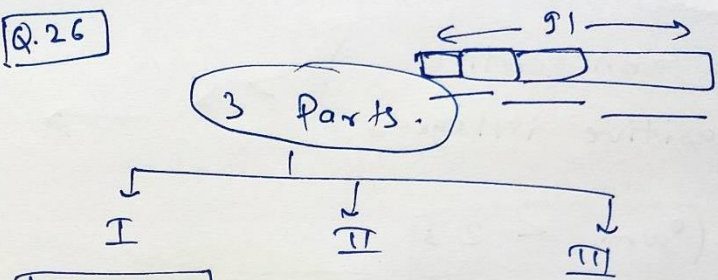
$$\Rightarrow 7x \geq 63$$

$$\Rightarrow \boxed{x \geq 9}$$

the shortest side ≥ 9

min. length of
the shortest side = 9 cm

Q.26



Shortest

x

$x+3$

$2x$

$$\Rightarrow \boxed{2x \geq (x+3) + 5}$$

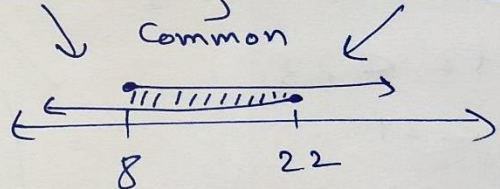
$$\Rightarrow x \geq 8$$

$$\Rightarrow \boxed{x \geq 8}$$

$$(x) + (x+3) + (2x) \leq 91$$

$$4x \leq 88$$

$$\boxed{x \leq 22}$$



$$\boxed{8 \leq x \leq 22}$$

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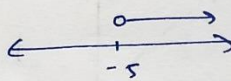
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Linear Inequalities

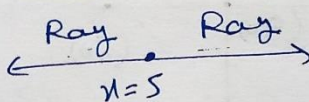
Ex. 6.2

L.I. in 1-variable.

(One-D) $x > -5$



$x = 5$ → Point.



$x \geq 5$

Solution set

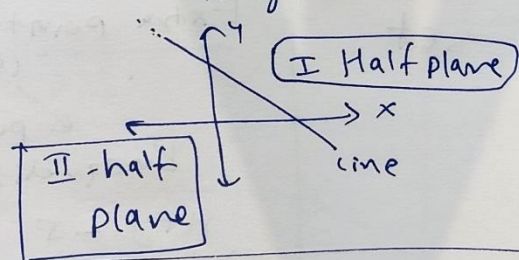
↓
(Ray) 1-D.

L.I. in 2 variables

$x + y > -5$

(2-D)

$x + y = 5$
Straight line



$x + y \geq 5$

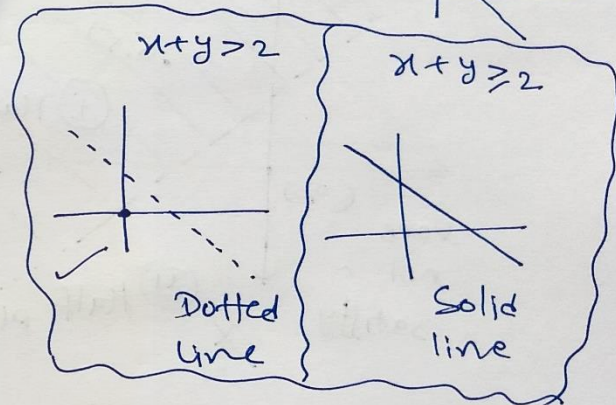
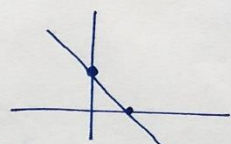
Solution set. → Halfplane

(x, y) Diagram.

Steps to Solve L.I. in 2-Variables

$x + y > 2$

(I) Graph → Line $x + y = 2$



(II) Take 3rd point
(other) (0,0)

★ Not on the given line

③ put this "other point"

in the inequality.

Satisfies does not Satisfy

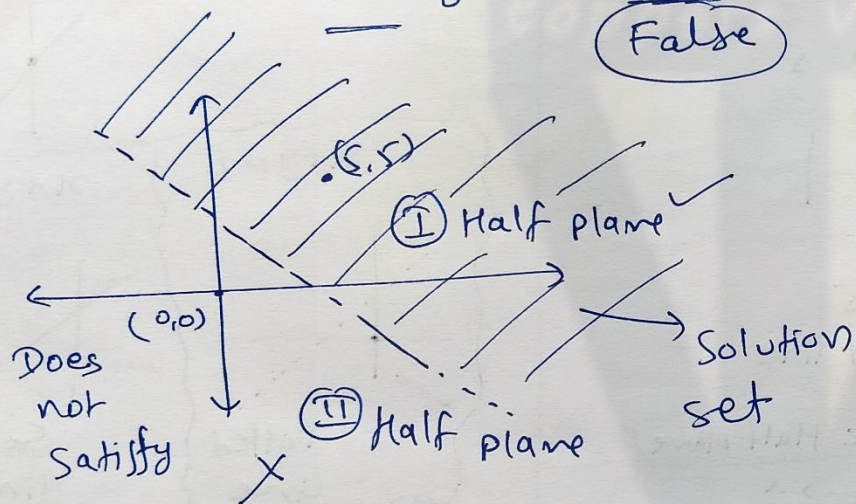
$(0,0)$ generally

$$x+y > 2$$

$$0+0 > 2$$

$$0 > 2$$

False



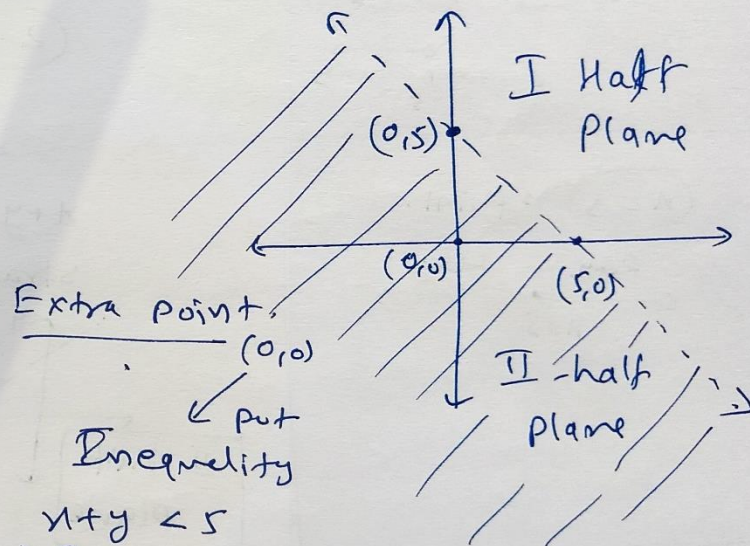
Exercise 6.2

Q.1

$$x+y < 5$$

Graph $\leftrightarrow x+y = 5$

$$(0,5) \quad (5,0)$$



$$x+y < 5$$

$$\Rightarrow 0+0 < 5$$

$$\Rightarrow 0 < 5$$

True

II-half plane which contains $(0,0)$ is the solution set.

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Class -11-Maths Exercise 6.2

② $2x + y \geq 6$

Graph Line $2x + y = 6$ Boundary
(0,6) (3,0)

Extra Point
(0,0)

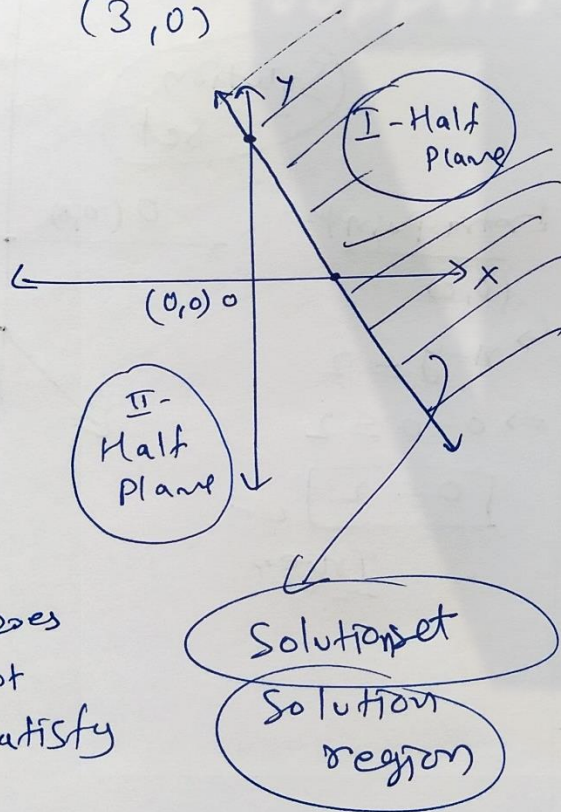
$2x + y \geq 6$

$\Rightarrow 0 + 0 \geq 6$

$0 \geq 6$

X

Does
Not
Satisfy



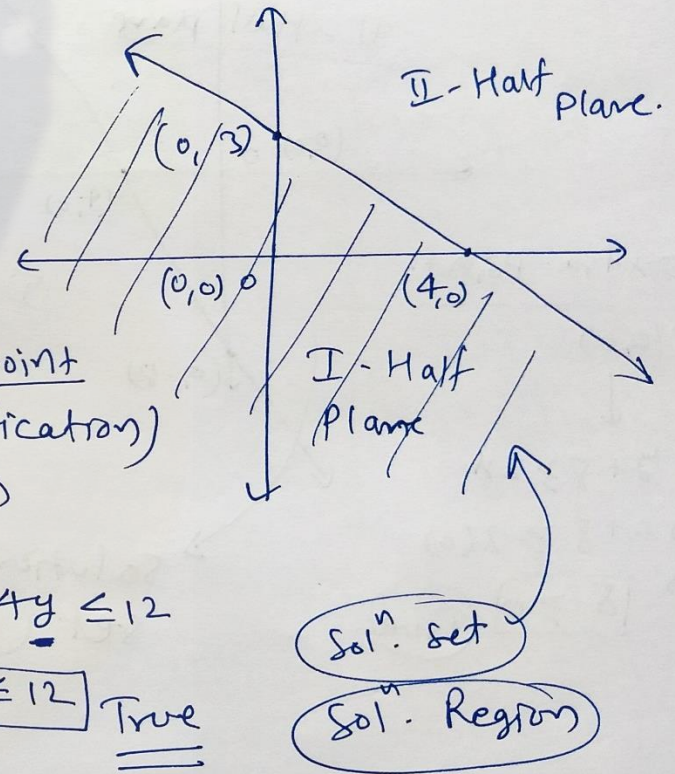
③ $3x + 4y \leq 12$

Graph (Border) $3x + 4y = 12$
(0,3) (4,0)

Extra point
(verification)
(0,0)

$3x + 4y \leq 12$

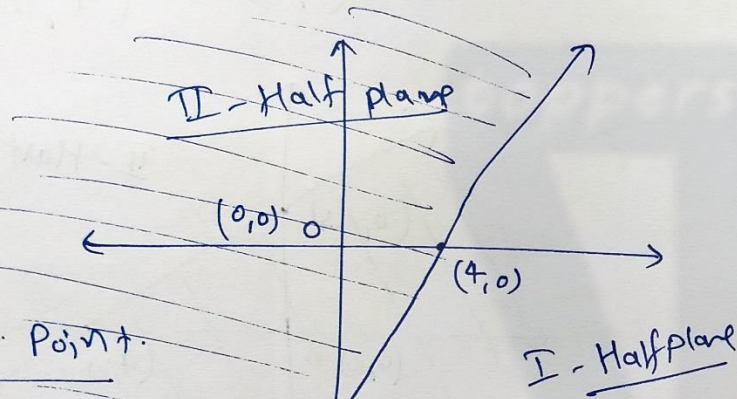
$\Rightarrow 0 \leq 12$ True



④ $x + 8 \geq 2x$

Graph: Border: $x + 8 = 2x$

$(0, -8)$ $(4, 0)$



Extra Point:

$(0, 0)$



$$x + 8 \geq 2x$$

$$\Rightarrow 0 + 8 \geq 2(0)$$

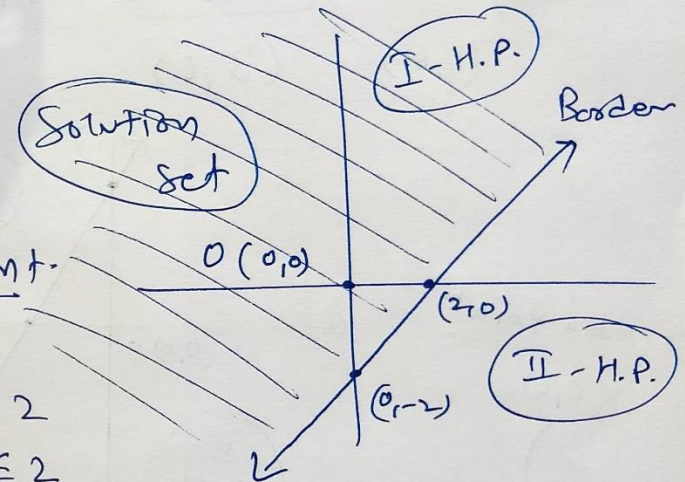
$$\Rightarrow 8 \geq 0 \quad \text{True}$$

Solution set (Region)

⑤ $x - y \leq 2$

Graph: Border $x - y = 2$

$(0, -2)$ $(2, 0)$



Extra Point:

$(0, 0)$

$$\hookrightarrow x - y \leq 2$$

$$\Rightarrow 0 - 0 \leq 2$$

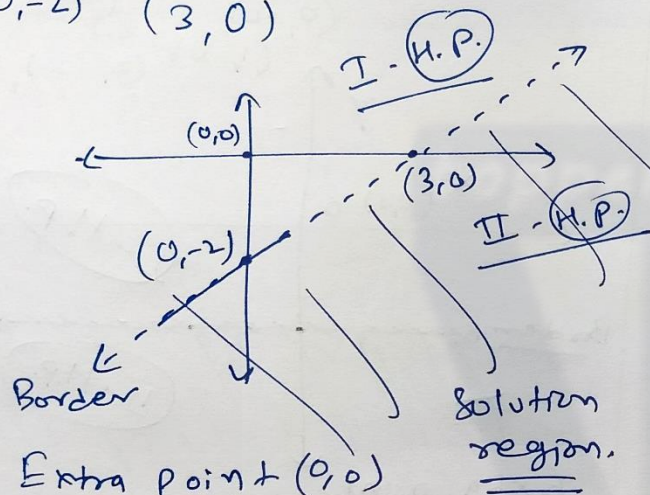
$$0 \leq 2$$

True

⑥ $2x - 3y > 6$

Border $2x - 3y = 6$

$(0, -2) \quad (3, 0)$



~~Extra~~ Extra point $(0, 0)$

$2x - 3y > 6$

$\Rightarrow 0 - 0 > 6$

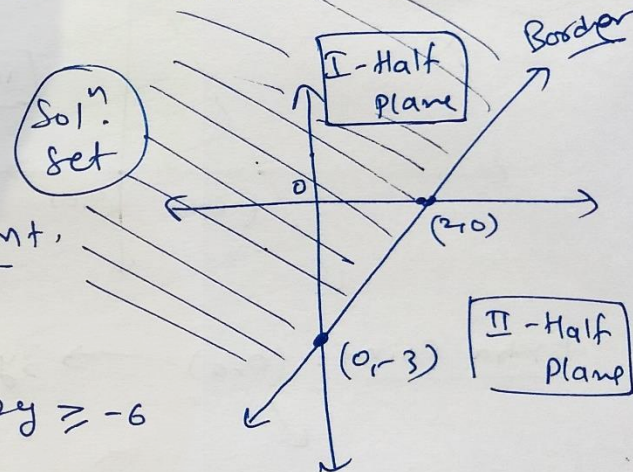
$\boxed{0 > 6}$ False
X

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Exercise 6.2

⑦ $-3x + 2y \geq -6$

Border $-3x + 2y = -6$ Line
 $(0, -3) \quad (2, 0)$



Extra point,

$0 (0, 0)$

$-3x + 2y \geq -6$

$\Rightarrow 0 + 0 \geq -6$

$\boxed{0 \geq -6}$ True, ✓

⑧ $3y - 5x < 30$

Border: $3y - 5x = 30$

$(0, 10)$

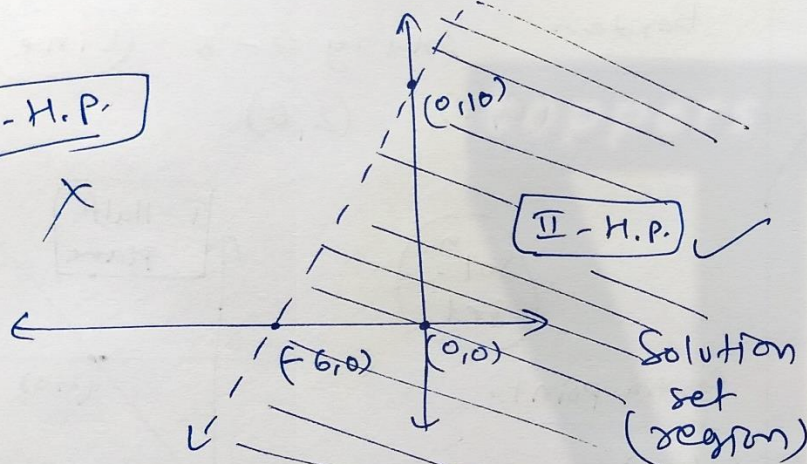
$(-6, 0)$

→ Border

I - H.P.

X

II - H.P.



Extra Point: $(0, 0) \rightarrow 3y - 5x < 30$

$0 - 0 < 30$

$\Rightarrow 0 < 30$ ✓

Satisfies

⑨ $y < -2$

Horizontal

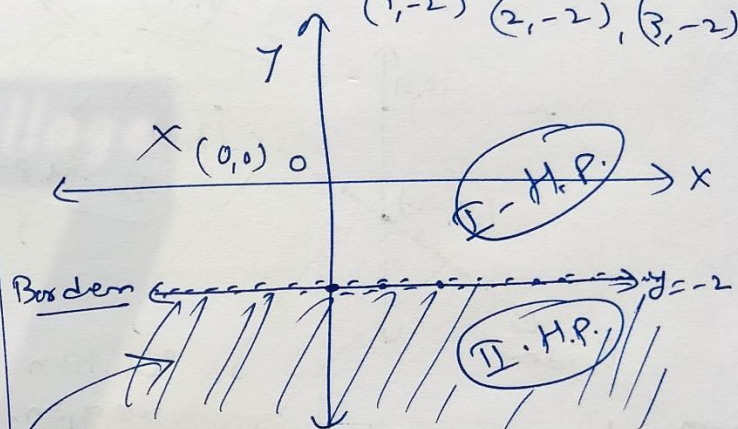
Border: $y = -2$ → Line

$(0, -2)$

$(1, -2)$

$(2, -2)$

$(3, -2)$



Extra point: $(0, 0) \rightarrow y < -2$

$\Rightarrow 0 < -2$

False.

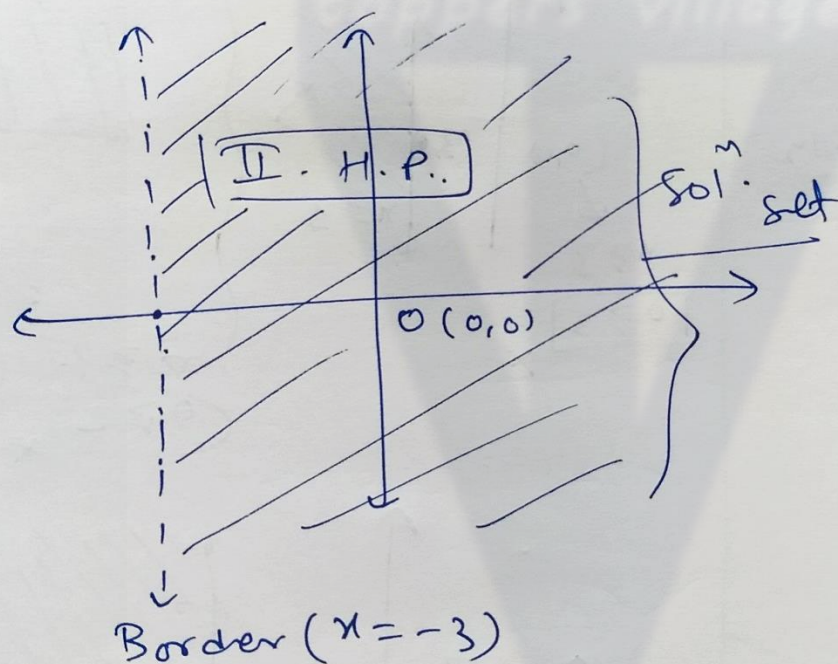
Solⁿ. Set,

⑩ $x > -3$

Border: $x = -3 \rightarrow \left\{ \begin{array}{l} \text{vertical} \\ \text{line} \end{array} \right\}$

$(-3, 0)$ $(-3, 1)$ $(-3, 10)$

I - H.P.



check (0,0)

$x > -3$

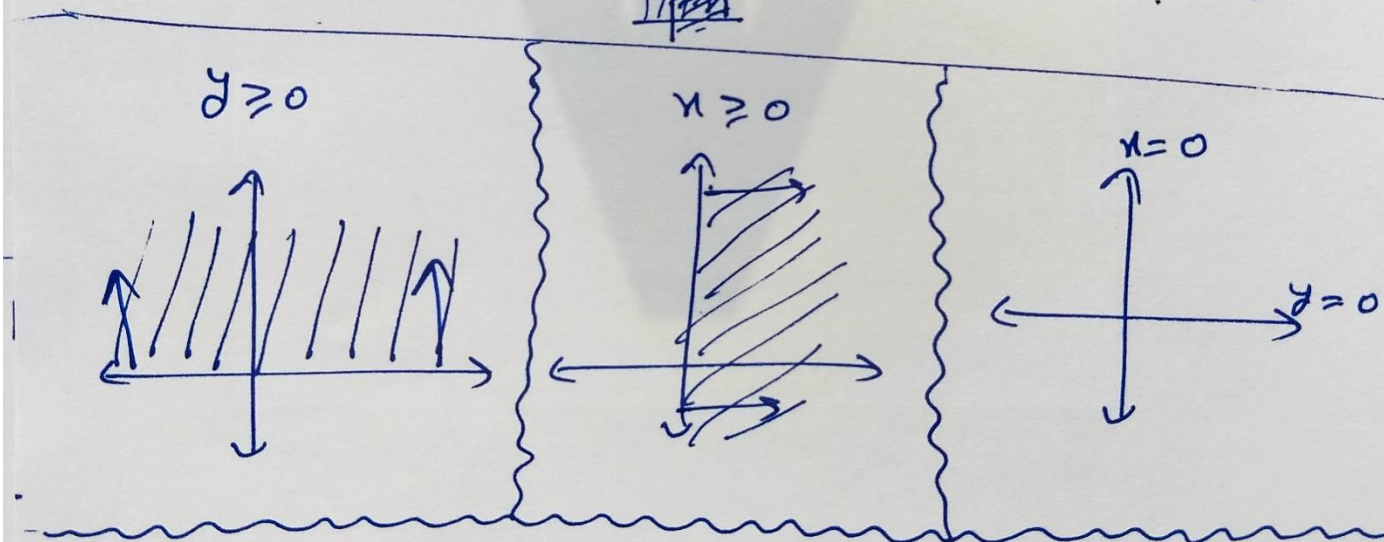
$0 > -3$ ✓

Perfect Approach for Ex. 6.3

① (=) (Line) (Border) $\longleftrightarrow \begin{matrix} \xrightarrow{\geq} \\ \xleftarrow{\leq} \end{matrix}$

② ($\geq$) (Half plane) (Region) $\begin{matrix} \nearrow \\ \nwarrow \end{matrix}$ $\begin{matrix} \nearrow \\ \nwarrow \end{matrix}$

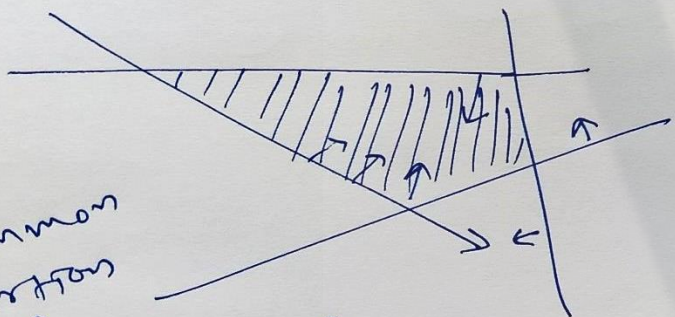
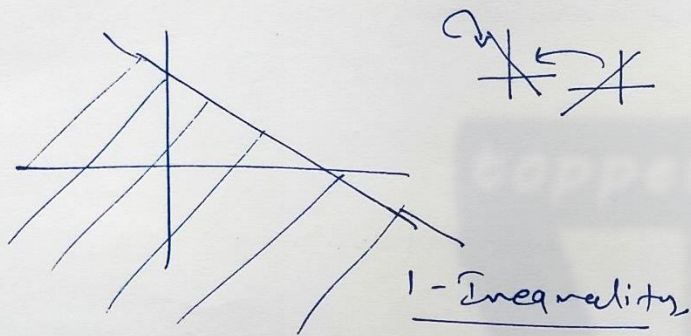
③ Common Sense (for Common Area)



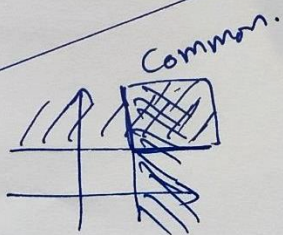
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Exercise 6.3



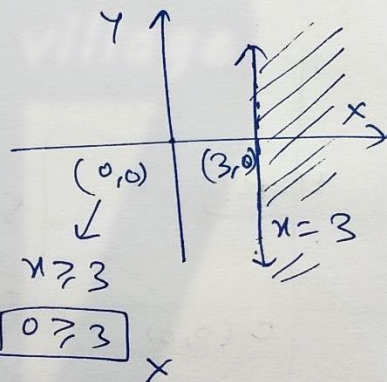
Shade $\rightarrow$ Solⁿ.



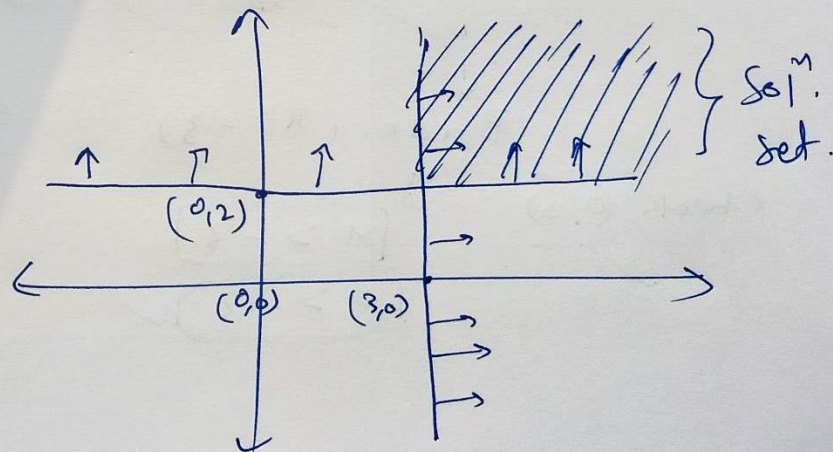
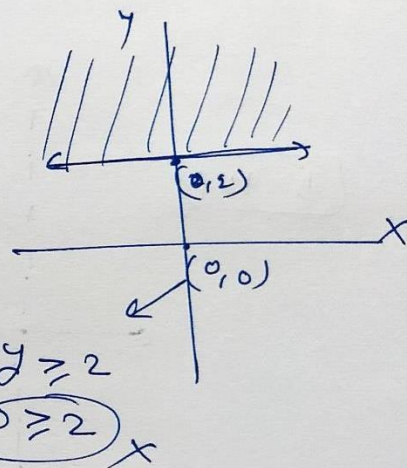
Q.1

$$x \geq 3, y \geq 2$$

$$x = 3 \quad (3, 0) (3, 5)$$



$$y \geq 2 \rightarrow y = 2$$

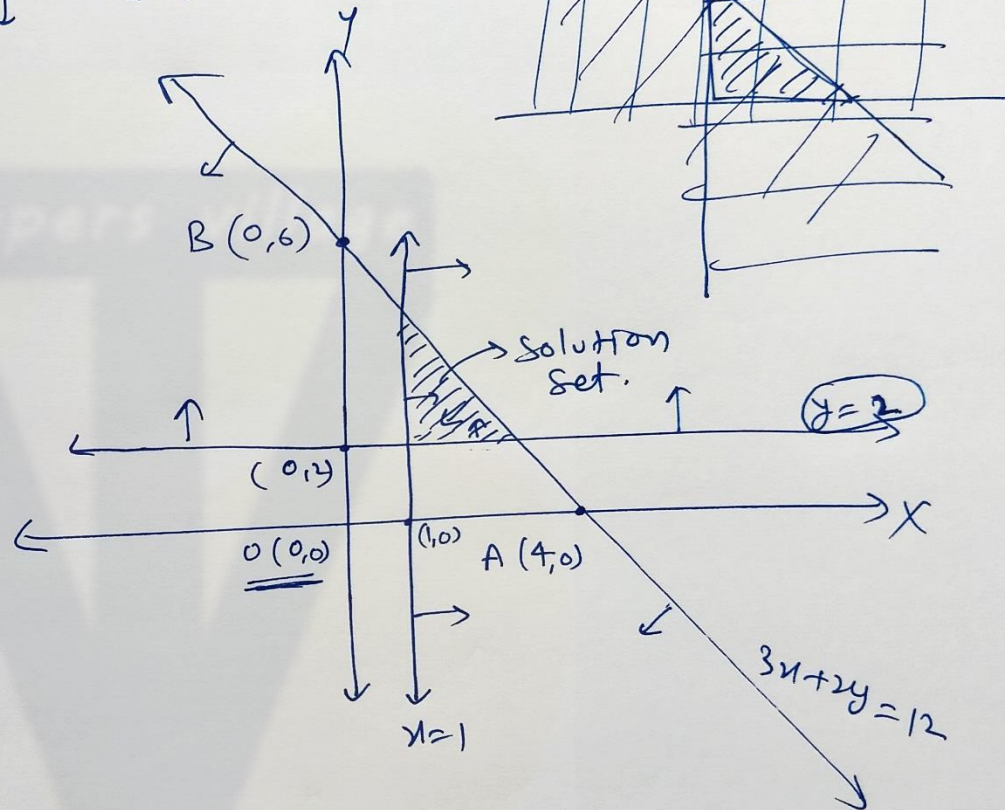


Q.2 $3x + 2y \leq 12$, $x \geq 1$, $y \geq 2$

Border $3x + 2y = 12$
 $(0, 6)$ $(4, 0)$

$(0, 0) \rightarrow 3x + 2y \leq 12$
 $0 + 0 \leq 12$
 $0 \leq 12 \checkmark$

$x = 1$
 $y = 2$



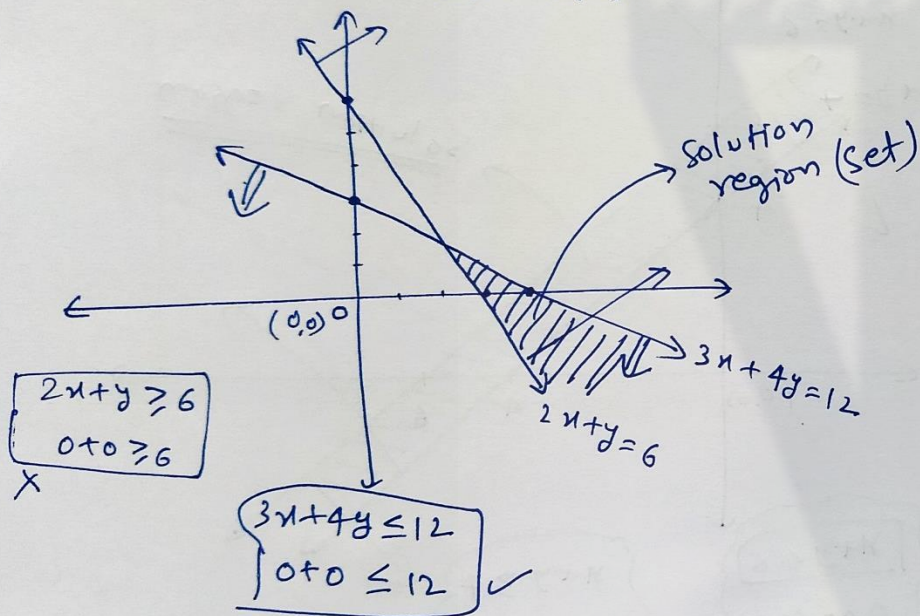
Toppers Village

Class 11 Maths Exercise 6.3 Linear Inequalities

Q.3 $2x + y \geq 6$, $3x + 4y \leq 12$

$2x + y = 6$
(0, 6) (3, 0)

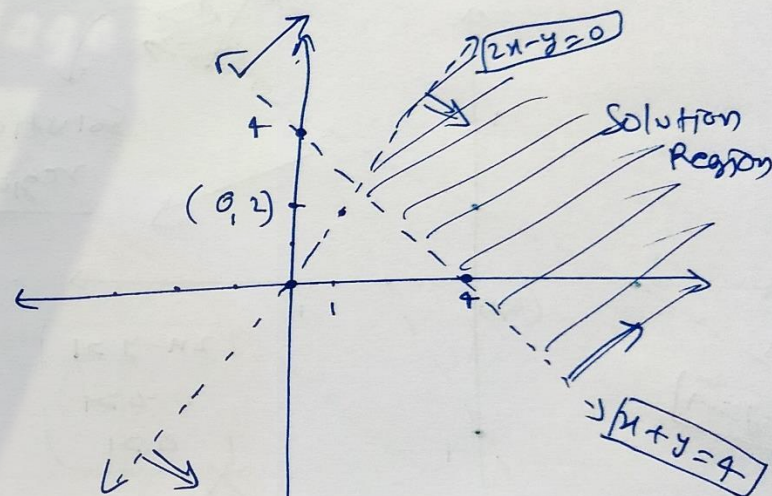
$3x + 4y = 12$
(0, 3) (4, 0)



Q.4 $x + y > 4$, $2x - y > 0$

$x + y = 4$
(0, 4) (4, 0)

$2x - y = 0$
(0, 0) (1, 2)



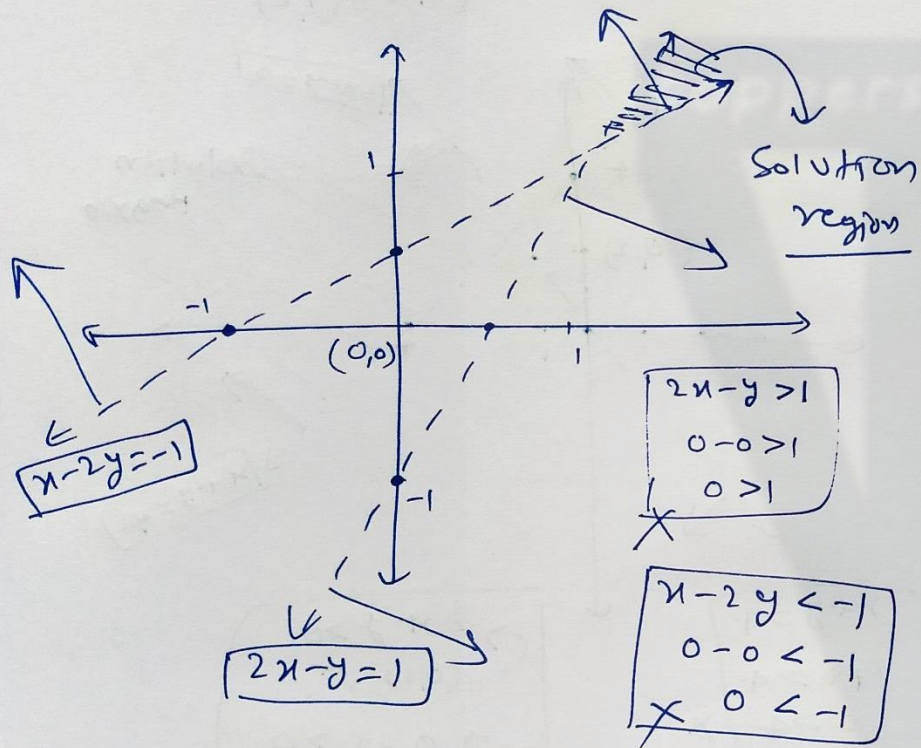
⑤ $2x - y > 1$, $x - 2y < -1$

$2x - y = 1$

$(0, -1), (\frac{1}{2}, 0)$

$x - 2y = -1$

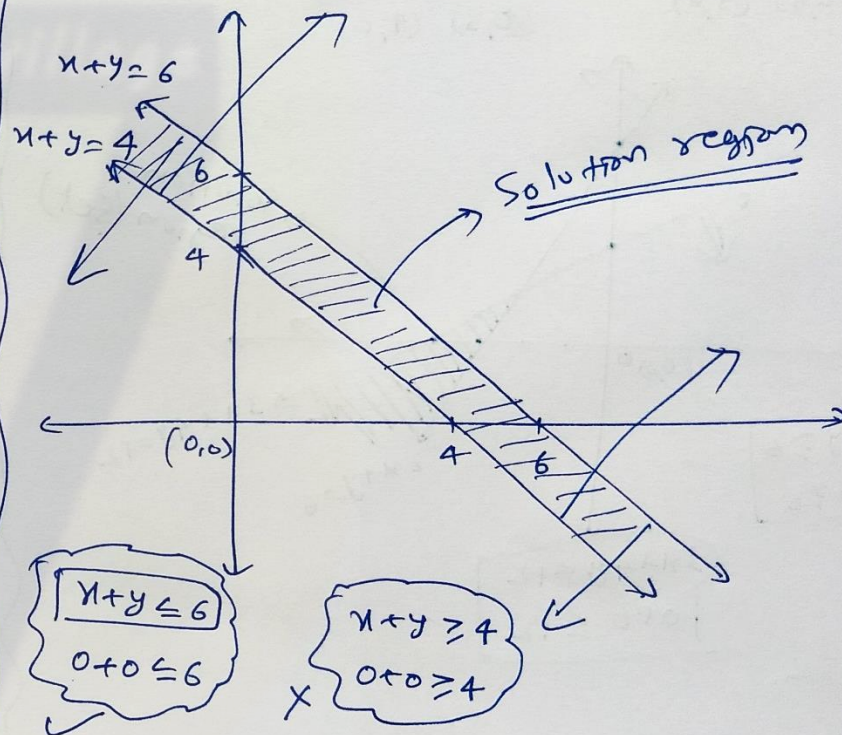
$(0, \frac{1}{2}), (-1, 0)$



Q.6 $x + y \leq 6$, $x + y \geq 4$

$x + y = 6$
 $(0, 6), (6, 0)$

$x + y = 4$
 $(4, 0), (0, 4)$



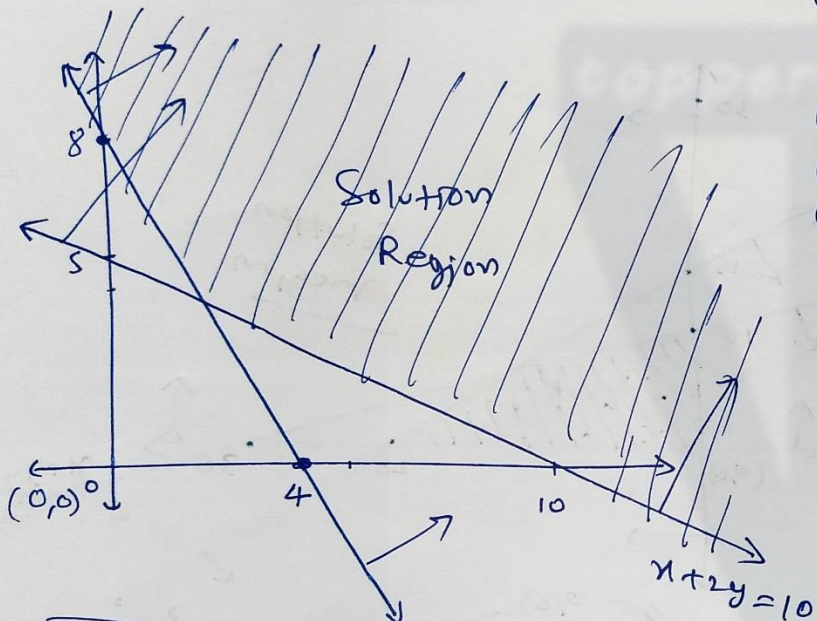
⑦ $2x + y \geq 8$ $x + 2y \geq 10$

$2x + y = 8$

$x + 2y = 10$

$(4, 0)$ $(0, 8)$

$(10, 0)$ $(0, 5)$



$(0, 0)$
 $2x + y \geq 8$
 $0 + 0 \geq 8$
 $\times$

$x + 2y \geq 10$
 $0 + 0 \geq 10$
 $\times$

Toppers Village

Exercise 6.3 Linear Inequalities

11th

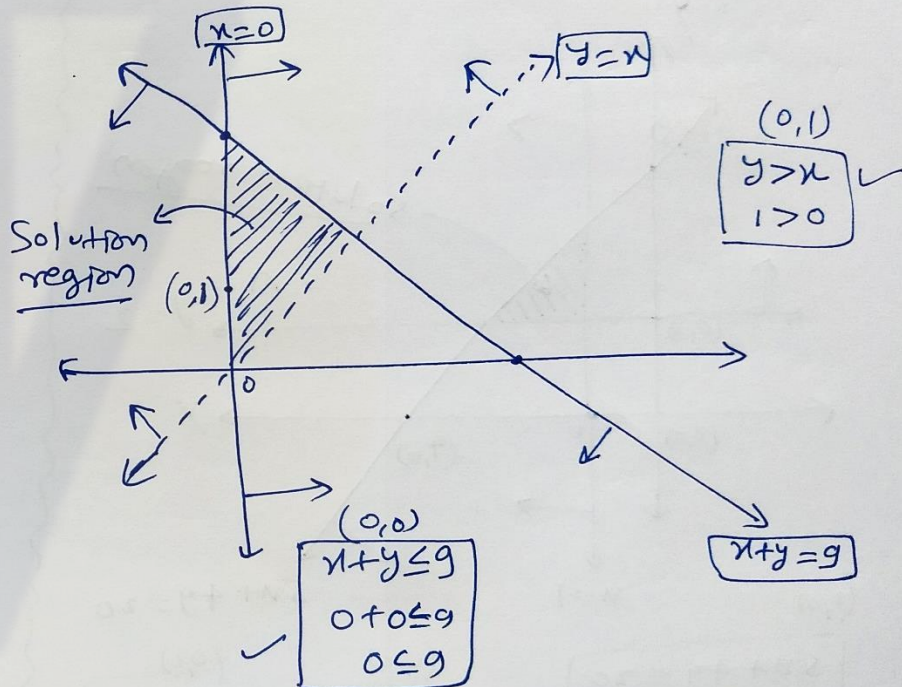
Q.8

$x + y \leq 9$, $y > x$, $x \geq 0$

$x + y = 9$
 $(0, 9)$ $(9, 0)$

$y = x$

$x = 0$ (y-axis)



Q.9 $5x + 4y \leq 20$, $x \geq 1$, $y \geq 2$

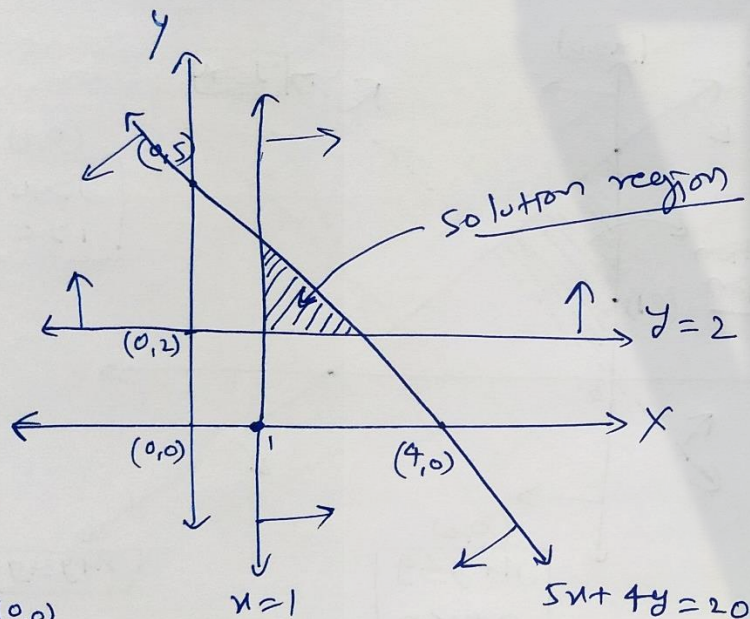
$5x + 4y = 20$

$(0, 5)$, $(4, 0)$

$x = 1$

$y = 2$

$(1, 0)$
 $(1, 1)$
 $(1, 2)$



$(0, 0)$

$5x + 4y \leq 20$
 $0 + 0 \leq 20$
 $0 \leq 20$

$(0, 0)$
 $x \geq 1$
 $0 \geq 1$

$(0, 0)$
 $y \geq 2$
 $0 \geq 2$

Q.10

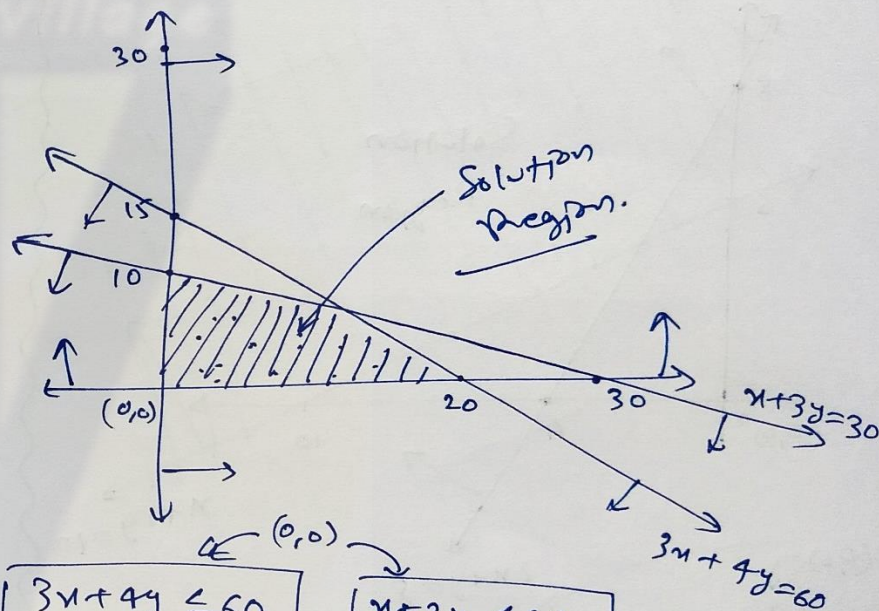
$3x + 4y \leq 60$, $x + 3y \leq 30$, $x \geq 0$, $y \geq 0$

$3x + 4y = 60$

$(0, 15)$ $(20, 0)$

$x + 3y = 30$

$(0, 10)$ $(30, 0)$

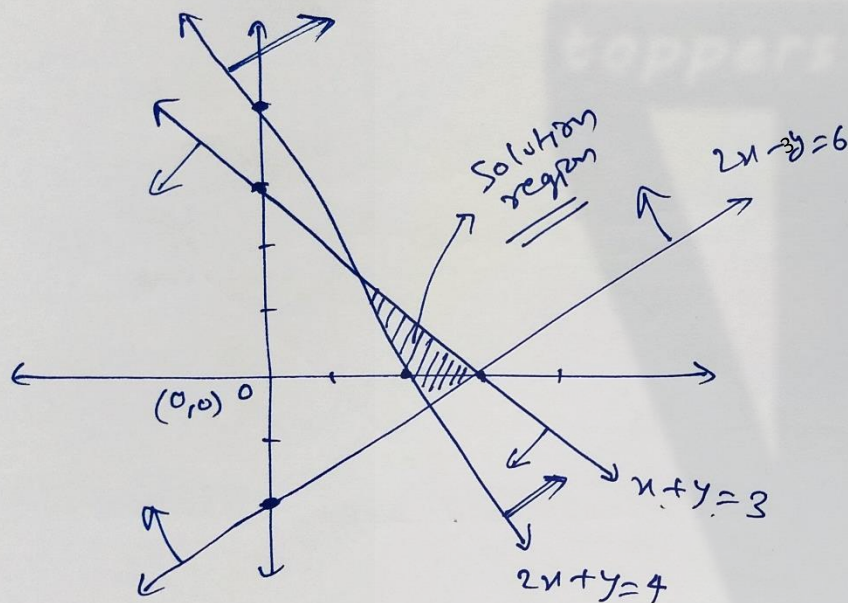


$3x + 4y \leq 60$
 $0 + 0 \leq 60$
 $0 \leq 60$

$x + 3y \leq 30$
 $0 + 0 \leq 30$
 $0 \leq 30$

⑪ $2x + y \geq 4$, $x + y \leq 3$, $2x - 3y \leq 6$

$\downarrow$ $\downarrow$ $\downarrow$
 $2x + y = 4$ $x + y = 3$ $2x - 3y = 6$
 $(0, 4) (2, 0)$ $(0, 3) (3, 0)$ $(0, -2), (3, 0)$

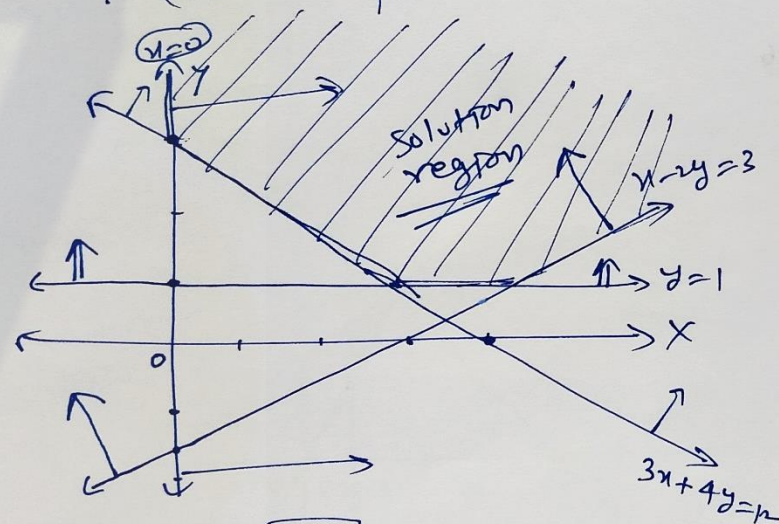


$2x + y \geq 4$	$x + y \leq 3$	$2x - 3y \leq 6$
$0 + 0 \geq 4$	$0 + 0 \leq 3$	$0 - 0 \leq 6$
$0 \geq 4$	$0 \leq 3$	$0 \leq 6$
X	✓	✓

Toppers Village Ex. 6.3

⑫ $x - 2y \leq 3$, $3x + 4y \geq 12$, $x \geq 0$, $y \geq 1$

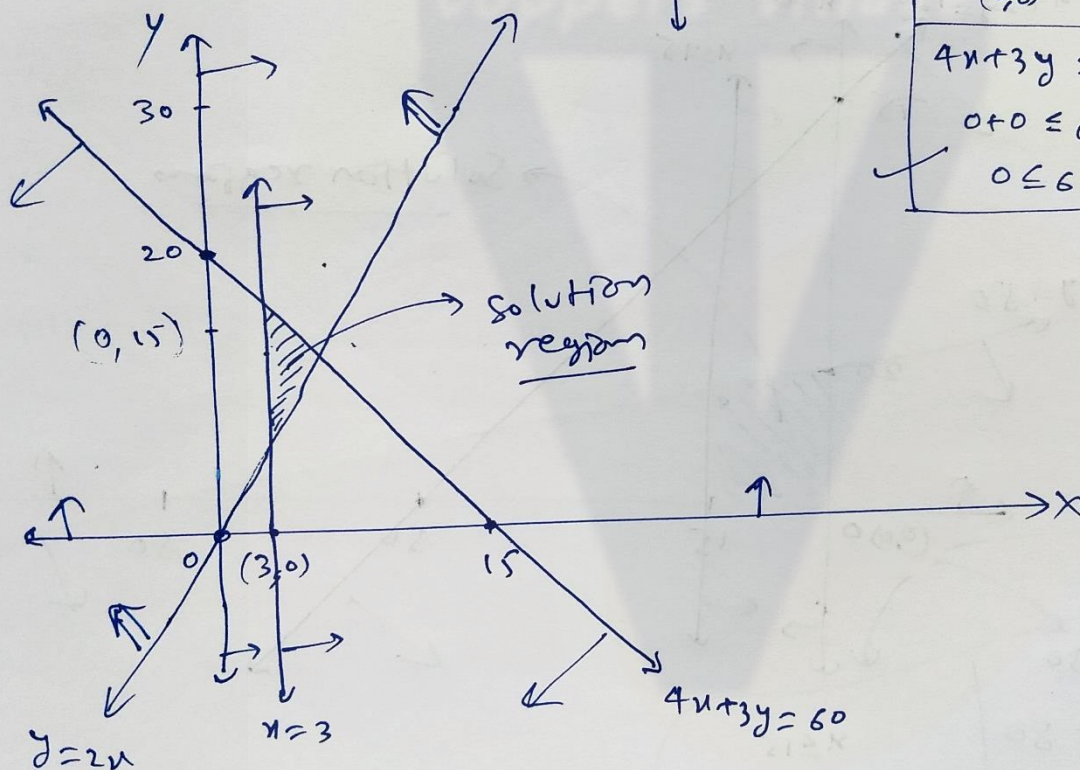
$\downarrow$ $\downarrow$ Direct $\downarrow$
 $x - y \cdot 2 = 3$ $3x + 4y = 12$ $y = 1$
 $(0, -1.5) (3, 0)$ $(0, 3) (4, 0)$ $\leftarrow$



$x - 2y \leq 3$	$3x + 4y \geq 12$	$y \geq 1$
$0 - 0 \leq 3$	$0 + 0 \geq 12$	$0 \geq 1$
$0 \leq 3$	$0 \geq 12$	X
✓	X	

⑬ $4x + 3y \leq 60$, $y \geq 2x$, $x \geq 3$, $x, y \geq 0$

$\downarrow$ $\downarrow$ $\downarrow$ $\swarrow \searrow$
 $4x + 3y = 60$ $y = 2x$ $x = 3$ $x \geq 0$ $y \geq 0$
 $(0, 20)$ $(15, 0)$ $(0, 0)$ $(15, 30)$ $x = 3$ vertical line Direct



$(0, 0)$
 $4x + 3y \leq 60$
 $0 + 0 \leq 60$
 $0 \leq 60$ ✓

$(0, 15)$
 $y \geq 2x$
 $15 \geq 0$ ✓

$(0, 0)$
 $x \geq 3$
 $0 \geq 3$ ✗

⑭ $3x + 2y \leq 150$

$x + 4y \leq 80$

$x \leq 15$

$y \geq 0$ $x \geq 0$

Border $3x + 2y = 150$

$x + 4y = 80$

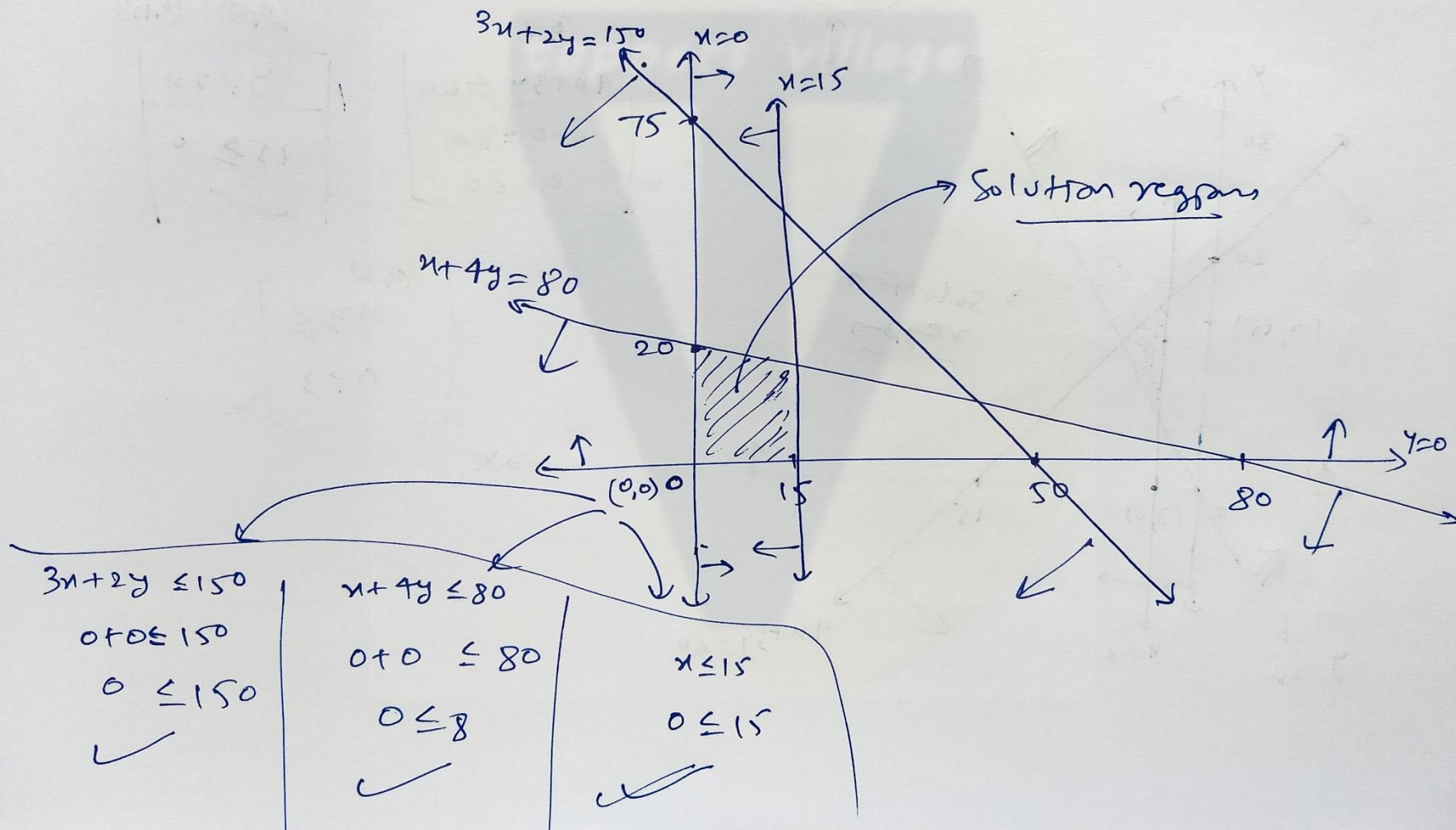
$x = 15$

Direct.

$(0, 75)$ $(50, 0)$

$(0, 20)$ $(80, 0)$

(vertical line)



(15) $x + 2y \leq 10$

Border $x + 2y = 10$

$(10, 0) \quad (0, 5)$

$x + y \geq 1$

$x + y = 1$

$(1, 0) \quad (0, 1)$

$x - y \leq 0$

$x - y = 0$

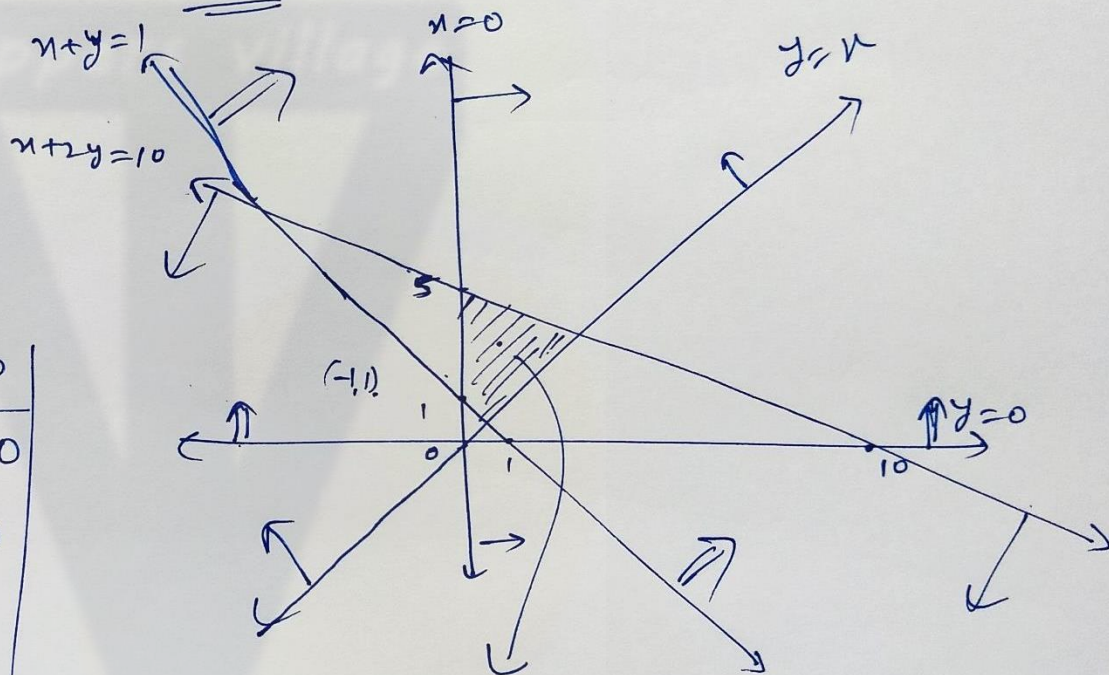
$y = x$

Direct

$x \geq 0 \quad y \geq 0$

Direct.

$(0, 0)$ ↓ $x + 2y \leq 10$	$(0, 0)$ ↓ $x + y \geq 1$	$(-1, 1)$ $x - y \leq 0$
$0 + 0 \leq 10$	$0 + 0 \geq 1$	$(-1) - (1) \leq 0$
$0 \leq 10$	$0 \geq 1$	$-2 \leq 0$
✓	✗	✓



Solution region

Miscellaneous Exercise on Chapter 6

11th

Questions 1 to 6

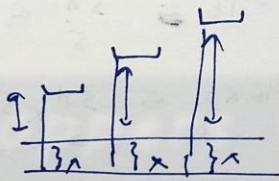
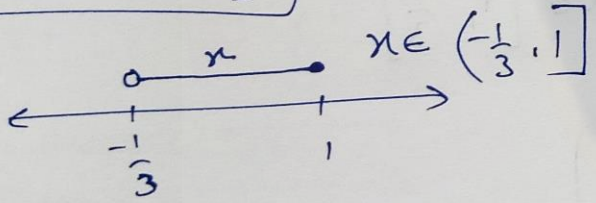
Double Inequality

e.g.
$$\begin{array}{ccccc} 1 & \leq & -3x+4 & < & 5 \\ -4 & & -4 & & -4 \end{array}$$

$$\Rightarrow -3 \leq -3x < 1$$

$$\Rightarrow \frac{-3}{-3} \geq \frac{-3x}{-3} > \frac{1}{-3}$$

$$\Rightarrow \boxed{1 \geq x > -\frac{1}{3}}$$



Divide by -3
Sign of Inequality changes.

[Q.1]
$$2 \leq 3x-4 \leq 5$$

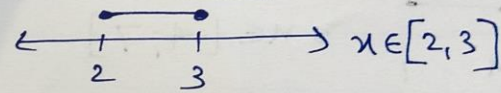
$\Rightarrow$ Add $+4$

$$2+4 \leq 3x-4+4 \leq 5+4$$

$\Rightarrow 6 \leq 3x \leq 9$

Divide '3' $\rightarrow$ $\oplus$ ve $\rightarrow$ No change in Sign

$\Rightarrow \boxed{2 \leq x \leq 3}$



[Q.2]
$$6 \leq -3(2x-4) < 12$$

$\Rightarrow \frac{6}{-3} \geq \frac{-3(2x-4)}{-3} > \frac{12}{-3}$

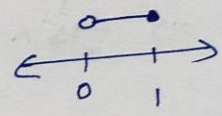
$\Rightarrow -2 \geq 2x-4 > -4$

$\Rightarrow 4-2 \geq 2x > -4+4$

$\Rightarrow 2 \geq 2x > 0$

$\Rightarrow 1 \geq x > 0$

-3 Divide
 $\downarrow$
Change



$x \in (0, 1]$

$$\boxed{\text{Q.3}} \quad -3 \leq 4 - \frac{7x}{2} \leq 18$$

$$\Rightarrow \quad \textcircled{-4} \quad \textcircled{-4} \quad \textcircled{+4}$$

$$-7 \leq \frac{-7x}{2} \leq 14$$

$$\text{Divide } \textcircled{\frac{-7}{2}}:$$

$$\Rightarrow \frac{+11}{\left(\frac{-7}{2}\right)} \geq x \geq \frac{14}{\left(\frac{-7}{2}\right)}$$

$$\Rightarrow 7 \geq x \geq -4$$

$$\leftarrow \begin{array}{|c|c|} \hline \bullet & \bullet \\ \hline -4 & 7 \end{array} \rightarrow x \in [-4, 7]$$

$$\boxed{\text{Q.4}} \quad -15 < \frac{3(x-2)}{5} \leq 0$$

$$\bullet \text{ multiply } \frac{5}{3}$$

$$\Rightarrow -15 \times \frac{5}{3} < (x-2) \leq 0$$

$$\Rightarrow \begin{array}{|c|c|c|} \hline -25 & x-2 & \leq 0 \\ \hline \textcircled{+2} & \textcircled{+2} & \textcircled{+2} \end{array}$$

$$\Rightarrow -23 < x \leq 2 \Rightarrow x \in (-23, 2]$$

$$\boxed{\text{Q.5}} \quad -12 < 4 - \frac{3x}{5} \leq 2$$

$$\Rightarrow -12 \leq 4 + \frac{3x}{5} \leq 2$$

$$\textcircled{-4} \quad \textcircled{-4} \quad \textcircled{-4}$$

$$\Rightarrow -16 \leq \frac{3x}{5} \leq -2 \quad (\text{multiply } \frac{5}{3})$$

$$\Rightarrow -16 \times \frac{5}{3} < \frac{3x}{5} \times \frac{5}{3} \leq -2 \times \frac{5}{3}$$

$$\Rightarrow \underbrace{-\frac{80}{3} < x \leq -\frac{10}{3}}_{\Rightarrow x \in \left(-\frac{80}{3}, -\frac{10}{3}\right]}$$

$$\boxed{\text{Q.6}} \quad 7 \leq \frac{3x+11}{2} \leq 11$$

$$\Rightarrow 14 \leq (3x+11) \leq 22$$

$$\Rightarrow 3 \leq 3x \leq 11$$

$$\Rightarrow 1 \leq x \leq \frac{11}{3}$$

$$x \in \left[1, \frac{11}{3}\right]$$

$$\leftarrow \begin{array}{|c|c|} \hline \bullet & \bullet \\ \hline 1 & \frac{11}{3} \end{array} \rightarrow$$

Miscellaneous Exercise on Chapter 6

(11th)

(7)

$$5x+1 > -24$$

Solve

$$5x-1 < 24$$

Solve.

→ common

Number line

easy

$$5x+1 > -24$$

$$\Rightarrow 5x > -25$$

$$\Rightarrow x > -\frac{25}{5}$$

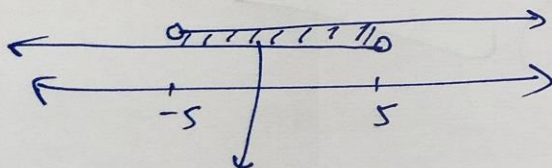
$$\boxed{x > -5}$$

$$5x-1 < 24$$

$$\Rightarrow 5x < 25$$

$$\Rightarrow x < \frac{25}{5}$$

$$\Rightarrow \boxed{x < 5}$$



Solution $x \in (-5, 5)$ ✓

(8)

$$2(x-1) < x+5$$

$$\Rightarrow 2x-2 < x+5$$

$$\Rightarrow 2x-x < 5+2$$

$$\Rightarrow \boxed{x < 7}$$



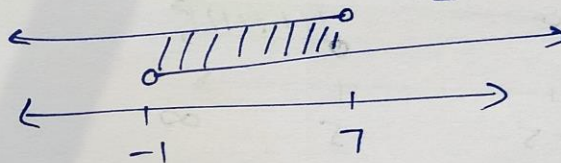
$$3(x+2) > 2-x$$

$$\Rightarrow 3x+6 > 2-x$$

$$\Rightarrow 3x+x > 2-6$$

$$\Rightarrow 4x > -4$$

$$\Rightarrow \boxed{x > -1}$$



$x \in (-1, 7)$ ✓

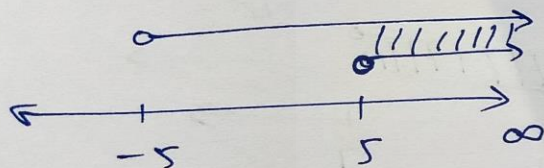
$$(9) \quad 3x - 7 > 2(x - 6)$$

$$\Rightarrow 3x - 7 > 2x - 12$$

$$\Rightarrow 3x - 2x > -12 + 7$$

$$\Rightarrow \boxed{x > -5}$$

↓



$$x \in (-5, \infty) \quad \checkmark$$

$$6 - x > 11 - 2x$$

$$\Rightarrow 2x - x > 11 - 6$$

$$\Rightarrow \boxed{x > 5}$$

↓

(10)

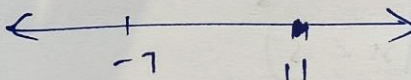
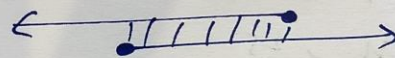
$$5(2x - 7) - 3(2x + 3) \leq 0$$

$$\Rightarrow 10x - 35 - 6x - 9 \leq 0$$

$$\Rightarrow 4x - 44 \leq 0$$

$$\Rightarrow 4x \leq 44$$

$$\Rightarrow \boxed{x \leq 11}$$



$$x \in [-7, 11] \quad \checkmark$$

$$2x + 19 \leq 6x + 47$$

$$\Rightarrow -6x + 2x \leq 47 - 19$$

$$\Rightarrow \frac{-4x}{-4} \leq \frac{28}{-4}$$

$$\Rightarrow \frac{-4x}{-4} \geq \frac{28}{-4}$$

$$\Rightarrow \boxed{x \geq -7}$$

'Toppers Village'

Miscellaneous Exercise on chapter 6

(11)

$$68 < \boxed{\text{Fahrenheit}} < 77$$

$$\underline{?} < \text{Celsius} < \underline{?}$$

$$\boxed{(F) = \left(\frac{9}{5}C + 32\right)}$$

$$\Rightarrow 68 < \frac{9}{5}C + 32 < 77$$

$$\begin{matrix} -32 & & -32 & & -32 \end{matrix}$$

$$\Rightarrow \left(\underline{36} < \underline{\left(\frac{9}{5}\right)C} < \underline{45} \right) \times \frac{5}{9}$$

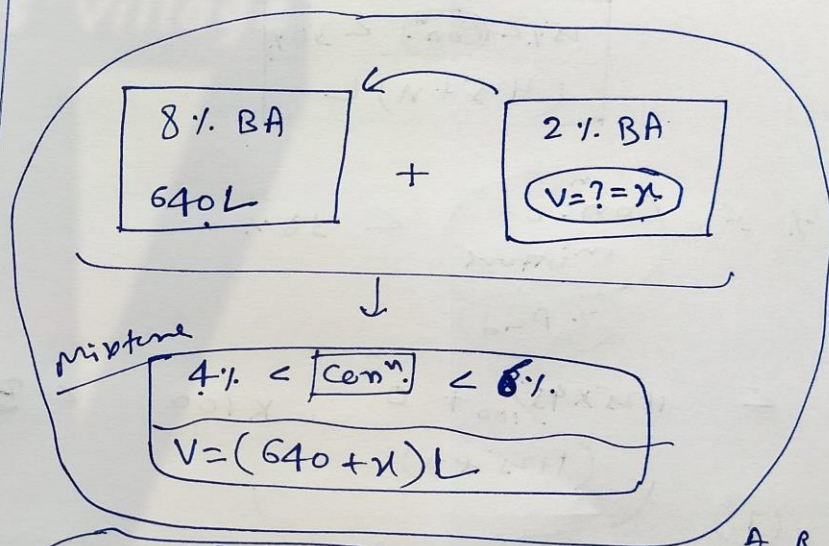
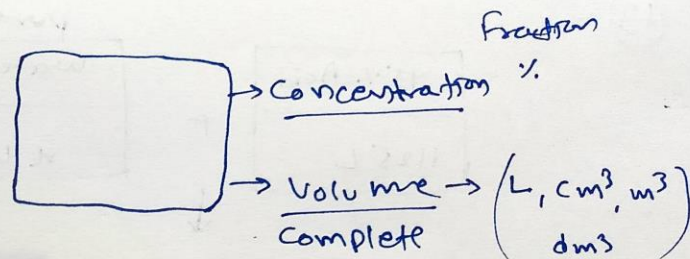
$$\Rightarrow \boxed{20 < C < 25}$$

Temperature in degree Celsius

between 20°C & 25°C

(12)

Solution



$$\% = \frac{\text{Interested}}{\text{total}} \times 100$$

$$\begin{matrix} A & B & C \\ 0 & 0 & 0 \\ 1 & 1 & 1 \end{matrix}$$

$$20 \quad 10 \quad 30 = 60$$

$$\%C = \frac{30}{60} \times 100$$

$$= 50\%$$

$$4\% <$$

Concentration
of
mixture

$$< 6\%$$

$$4 < \frac{\text{vol.}^m \text{ of (B.A.)}}{\text{total volume}} \times 100 < 6$$

$$4 < \left(\frac{640 \times \frac{8}{100} + \frac{2}{100} \times n}{(640+n)} \right) \times 100 < 6$$

+

$$4 \times \left(\frac{640+n}{100} \right) < \left(640 \times \frac{8}{100} + \frac{2}{100} \times n \right) < 6 \times \left(\frac{640+n}{100} \right)$$

Double inequality.

$$\textcircled{I} \quad 2 \times \left(\frac{640+n}{100} \right) < 640 \times \frac{8}{100} + \frac{2n}{100}$$

$$\Rightarrow 1280 + 2n < 2560 + n$$

$$\Rightarrow 2n - n < 2560 - 1280$$

$$\Rightarrow \boxed{n < 1280}$$

ii

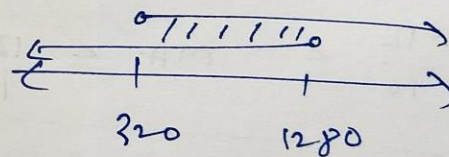
$$640 \times \frac{8}{100} + \frac{2}{100} \times n < 6 \times \left(\frac{640+n}{100} \right)$$

$$\Rightarrow 2560 + n < 1920 + 3n$$

$$\Rightarrow 640 < 2n$$

$$\Rightarrow \boxed{320 < n}$$

$$320 < n, \quad n < 1280$$

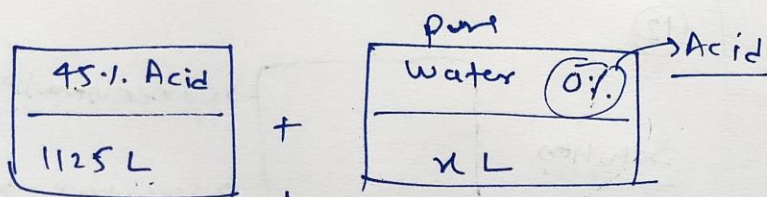


$$n \in (320, 1280)$$

2%

$$320 < n < 1280$$

13



25% < Conv. < 30%
(1125 + x) L

$$25\% \leq \text{Con. of mixture} < 30\%$$

(Conv. of mixture)

(Y. Acid)

$$\Rightarrow 25 < \frac{1125 \times \frac{45}{100} + 0}{(1125 + x)} \times 100 < 30$$

(I)

$$25 < \frac{1125 \times \frac{45}{100}}{(1125 + x)} \times 100$$

(II)

$$\Rightarrow 25 \times 1125 + (25 \times x) < 45 \times 1125$$

$$\Rightarrow 25 \times x < 1125 \times 20$$

$$\Rightarrow x < \frac{1125 \times 20}{25}$$

$$\Rightarrow x < 45 \times 20$$

$$\Rightarrow x < 900$$

(II)

$$\frac{1125 \times \frac{45}{100}}{(1125 + x)} \times 100 < 30$$

$$\Rightarrow 1125 \times 45 < 30 \times 1125 + 30x$$

$$\Rightarrow 1125 \times 15 < 30x$$

$$\Rightarrow \frac{1125 \times 15}{30} < x$$

$$\Rightarrow 562.5 < x$$

$$562.5 < x$$

$$x < 900$$

$$x \in (562.5, 900)$$

⑭

$$IQ = \frac{MA}{CA} \times 100$$

MA → mental Age → ?

CA → Chronological Age → 12 years

$$80 \leq IQ \leq 140$$

$$\Rightarrow 80 \leq \frac{MA}{CA} \times 100 \leq 140$$

$$\Rightarrow \left[80 \leq \frac{MA \times 100}{12} \leq 140 \right] \times \frac{12}{100}$$

$$\Rightarrow 8 \times \frac{12}{10} \leq MA \leq \frac{12 \times 14}{10}$$

$$\Rightarrow \left[9.6 \leq \underline{MA} \leq 16.8 \right]$$

All Useful Links:

- **YouTube Channel : Toppers Village** (Get full and free video lectures of Class 10 & 11 Maths) - <https://www.youtube.com/toppersvillage>
- **Website :** www.toppersvillage.com
- **Instagram :** <https://www.instagram.com/toppersvillage/>
- **Facebook Page:** www.facebook.com/ToppersVillage/
- **Facebook Group:** <https://www.facebook.com/groups/ToppersVillage>